

ACCIDENT

Aircraft Type and Registration:	Stampe SV4C (Modified), G-BIMO	
No & Type of Engines:	1 de Havilland Gipsy Major 10 Mk 2 piston engine	
Year of Manufacture:	1946	
Date & Time (UTC):	10 July 2010 at 1640 hrs	
Location:	Near Rotherfield Peppard, Oxfordshire	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - 1
Injuries:	Crew - 1 (Fatal)	Passengers - 1 (Fatal)
Nature of Damage:	Aircraft destroyed	
Licence:	Private Pilot's Licence	
Age:	41 years	
Flying Experience:	About 179 hours (of which 95 were on type) Last 90 days - at least 8.5 hours Last 28 days - Not known	
Information Source:	AAIB Field Investigation	

Synopsis

The aircraft entered an inverted spin during an unsuccessful attempt to perform a rolling aerobatic manoeuvre and impacted the ground, causing the two occupants to receive fatal injuries. No technical defects were found that could have contributed to the accident.

History of the flight

The aircraft departed White Waltham Airfield at about 1530 hrs for a local flight. The owner, who was PPL-qualified, was seated in the front cockpit and a friend of his, also PPL-qualified, was seated in the rear. The majority of the flight and the entire accident sequence were recorded by a digital video camera mounted on the owner's helmet. The history of the

flight was reconstructed from a combination of the video evidence, eyewitness statements and recorded radar data. Despite the video evidence, it was not possible to determine who was flying the aircraft.

The aircraft departed to the west of White Waltham, climbing steadily to a peak recorded altitude of 3,650 ft as indicated by the front cockpit altimeter. After making various gentle climbing turns, the aircraft tracked in a generally southerly direction. It then conducted a 180° level turn to track approximately north.

Video evidence of the accident manoeuvre shows that the aircraft pitched nose-down and accelerated to 110 kt at 3,400 ft, before pitching nose-up. The attitude

was stabilised with the nose above the horizon. The aircraft then commenced a slow roll to the right, with the nose remaining above the horizon until the aircraft had rolled past the inverted. The roll continued, but the aircraft's flight path then became 'spooned', resembling the helical profile of a barrel roll. The aircraft appears to have departed controlled flight during the roll, with the departure developing into an inverted spin which continued for eight turns until the aircraft entered the tree canopy, some 37 seconds after commencing the roll. Both occupants received fatal injuries in the ground impact. Several eyewitnesses observed the aircraft's uncontrolled descent.

Aircraft information

The Stampe SV4C is a two-seat biplane of predominantly wooden construction which has been used extensively for aerobatics. G-BIMO was built in 1946 and was placed on the UK civil register in 1981. In 1995 it underwent a major modification involving replacement of the original Renault engine with a De Havilland Gipsy Major 10 Mk 2 engine and a Hoffmann wooden propeller.

In addition to the two tandem pilots' seats, the fuselage incorporated a locker, with a hinged forward door, positioned under the curved upper decking aft of the rear seat. Small items of loose equipment could be placed therein and were retained by the closed door. The fuel system incorporated a single tank positioned in the centre of the upper wing. This location is close to the empty longitudinal centre of gravity (CG) of the aircraft. G-BIMO utilised a 'flop tube' fuel pick-up arrangement to ensure that fuel could be drawn from the tank irrespective of aircraft's attitude or direction of acceleration.

Accident site

The wreckage of the aircraft came to rest in woodland. The on-site evidence was consistent with the aircraft having struck the treetops at a very steep flight path angle, with its longitudinal axis orientated beyond the vertical. The aircraft was structurally complete at the initial impact with the trees. The extent of the damage sustained by the aircraft in its passage through the trees and the ground impact was consistent with a relatively low descent speed. The four wing surfaces were relatively lightly damaged and were geometrically disposed in approximately their correct relative positions. A considerable proportion of the wooden forward fuselage had been destroyed.

Damage to the wooden propeller, and horizontal slash marks on a vertical tree trunk, indicated that the engine was turning at a low rpm, but was delivering some power during the impact sequence. Substantial quantities of loose items associated with the aircraft and items of clothing were recovered from the accident site.

Detailed wreckage examination

The aircraft wreckage was recovered to the AAIB facilities for detailed examination. The flying controls were found to be correctly connected, except where obvious impact damage had occurred. No evidence of control restriction was found.

External examination of the fuel system and strip examination of the engine revealed no evidence of pre-impact failure. The aviation-related items and clothing recovered from the vicinity of the site were collected and were found to be capable of all being securely stowed simultaneously within the fuselage locker on another aircraft of the same type.

There was no evidence available to allow the quantity of fuel on board the aircraft at the time of the accident to be established.

Weight and balance

A weight and balance calculation was performed by the AAIB using the empty weight and CG position established when the aircraft was weighed in 1995. The post-mortem occupant weights were used, together with the total mass of the loose items, all of which were assumed to have been placed in the locker behind the rear seat. As the fuel contents at the time of the accident were unknown, various possibilities were considered.

In general, it appeared that with the tank more than approximately half-full, the CG would have been within specified limits, but the total weight would have exceeded the maximum aerobatic limit. With a low fuel load the CG would have been further aft and could have been close to, or just beyond, the specified aft limit.

Pilot experience

The owner and his friend had completed PPL courses at the same flying school during 2008. The flying school had retained their training records, which showed that they had made good progress throughout the course. Both had around 200 hours total flying experience.

According to the owner's flying logbook, he gained his PPL after approximately 73 hours. He then undertook differences training on the Stampe with a qualified flying instructor, who was approved to teach aerobatics. He completed his differences training after approximately 15 hours.

According to the instructor, the owner undertook aerobatics training with him and had reached the stage

where he was competent to perform aileron rolls and loops solo. The instructor had demonstrated stall turns, half-Cubans and barrel rolls to the owner, but the owner was reportedly not yet competent in performing these.

In total, the owner's logbook had 21 entries referring to some form of aerobatics, mainly loops and rolls and almost all with him recorded as pilot in command. Although the instructor had checked out the owner on flying the Stampe from the rear seat, the owner was legally permitted to fly the aircraft from either seat.

Shortly after qualifying for his PPL, the owner's friend purchased a share in a Jungmann. During his differences training, his instructor had demonstrated some basic aerobatic manoeuvres to him. It is believed that the owner's friend had completed about 23 hours on the Jungmann; his most recent flight in it was August 2009. The majority of the remainder of his flying had been in 'club' type aircraft, with the exception of about 14 hours in a Harvard, in October 2009. He had maintained his tailwheel currency on a Piper Cub.

Medical information

The owner and his friend held current JAA Class 2 medicals. A specialist aviation pathologist conducted post-mortem examinations on both. He reported that there was no evidence of significant natural disease. The toxicology results for the owner showed the presence of drugs related to the emergency medical treatment following the accident. The results showed both occupants blood alcohol concentration to be below the 20mg/100ml legal limit for flying in the UK.

Survivability

The owner initially survived the accident and was extracted from the aircraft wreckage by the emergency services while still conscious and able to talk.

However, he had sustained multiple internal injuries and his condition quickly deteriorated, despite rapid and intensive medical intervention. He was declared deceased at 1900 hrs on the day of the accident. Given the high impact forces he experienced, it is unlikely that he would have survived, even with additional protective equipment.

Both occupants were wearing Kevlar helmets with leather covers. The owner's helmet was labelled with his name and was fitted with a foam liner and featured a 'Velcro' patch on the right ear muff for the attachment of the helmet-mounted video camera.

The owner's friend was wearing a helmet of identical design and construction as the owner's. It was labelled with the same serial number and had an engraved brass plate on it. However, this helmet did not have the foam liner fitted. A helmet bag recovered from the aircraft wreckage contained a range of sizes and thicknesses of foam inserts intended to fit within the Kevlar shell of the helmet. These are designed to allow the helmet to be fitted to different head sizes and to provide a compressible layer to reduce the peak deceleration experienced by the head during an impact. The pathologist who conducted the post-mortems reported that:

'Using the helmet without the liner would significantly reduce the protection the helmet would afford against impact-related deceleration, although it is uncertain as to the effect on survivability this would have had in this particular accident.'

Meteorology

The London Heathrow METAR for the time of the accident gave reported conditions of: wind less than

10 kt, no cloud, greater than 10 km visibility, surface temperature of 28°C and a QNH of 1016 mb.

UK aerobatics regulations

There is currently no requirement in the UK for pilots to have completed any formal training in aerobatics before being permitted to conduct them as pilot in command. However, the CAA recommends that pilots receive such training before conducting aerobatics. The Aircraft Owners & Pilots Association (AOPA) publishes training syllabi for Basic, Standard and Intermediate level aerobatics. The Basic course comprises a minimum of eight hours of dual flying tuition with an approved instructor and eight hours of ground school. CAA Safety Sense Leaflet 19 entitled '*Aerobatics*' refers to the AOPA course.

EASA Proposal

On 26 August 2010, the European Aviation Safety Agency published a proposal to the European Commission for a harmonised regulation on Flight Crew Licensing (FCL). These proposals will become law in 2012. An aerobatic rating is included within the proposals, as outlined below:

'FCL.800 Aerobatic rating

(a) Holders of a pilot licence for aeroplanes, TMG or sailplanes shall only undertake aerobatic flights when they hold the appropriate rating.

(b) Applicants for an aerobatic rating shall have completed:

(1) at least 40 hours of flight time or, in the case of sailplanes, 120 launches as PIC in the appropriate aircraft category, completed after the issue of the licence;

(2) a training course at an ATO (Approved Training Organisation), including:

(i) theoretical knowledge instruction appropriate for the rating;

(ii) at least 5 hours or 20 flights of aerobatic instruction in the appropriate aircraft category.

(c) The privileges of the aerobatic rating shall be limited to the aircraft category in which the flight instruction was completed. The privileges will be extended to another category of aircraft if the pilot holds a licence for that aircraft category and has successfully completed at least 3 dual training flights covering the full aerobatic training syllabus in that category of aircraft.'

CAA Safety Sense Leaflet 19

CAA Safety Sense Leaflet 19 recommends the wearing of lightweight helmets and states that parachutes may be the only way to avoid a fatal accident following failure to recover from a manoeuvre. It further states:

*'you **must** now become familiar with entry to and recovery from a fully developed spin since a poorly executed aerobatic manoeuvre can result in an unintentional spin.'* (Original bold)

and:

'Know the spin characteristics of the aircraft even though you may have no intention of entering a spin. Know also the different symptoms of erect and inverted spins and the appropriate recovery drills for each type of spin.'

Analysis

It was evident from the helmet camera video recording that an unsuccessful attempt was made to perform a rolling aerobatic manoeuvre. The aircraft entered the rolling manoeuvre at an appropriate speed, however, in executing the manoeuvre, the aircraft departed from controlled flight into an inverted spin from which it did not recover.

The inverted spin commenced at a height from which recovery was theoretically possible for a pilot with the appropriate experience or training. However, an inverted spin is highly disorientating and it would be very difficult for a pilot with limited aerobatic experience to recognise the spin orientation and achieve a successful recovery.

The owner normally flew the aircraft from the rear seat. It was not possible to determine why he was seated in the front on this flight, but he was legally permitted to fly the aircraft from either seat. There was insufficient evidence available to determine which pilot was handling the aircraft during the flight.

It is not known whether the use of the liner would have prevented the owner's friend from receiving fatal injuries.

Conclusions

The accident resulted from an unsuccessful attempt to perform a rolling aerobatic manoeuvre, which led to the loss of control of the aircraft.

The CAA recommends that pilots become familiar with the symptoms of and recovery techniques for erect and inverted spins. In practice, successful recovery from an inverted spin entered at a height of around 3,500 ft

would be very difficult for a pilot with limited aerobatic experience.

The EASA aerobatics rating requirement will come into effect in 2012.